Finance Section 4: Introduction to Loan Calculation

Goal: Think about loan calculations intuitively.

1. (Basic Example:) Suppose you take out a loan for $10,000 with an annual interest rate of 5% compounded annually and you are going to make payments annually.

    (a) What is the *minimum* annual payment that ensures you will eventually pay of the loan? (Round your answer to the nearest dollar.)

    You have to pay more than the interest!

    $(\$10,000)(0.05) = \$500.$ So you must pay at least $501

    (b) Suppose you decided to have annual payments of $600, how much do you owe at the end of one year? (So one year of interest added and one year of payments subtracted.)

    at the end of 1 year:

    $A = 10,000(1 + 0.05) - 600 = 10500 - 600 = 9900.00$

    (c) How much do you owe at the end of the second year? The third year?

    end of year 2
    $A = 9900(1 + 0.05) - 600 = 9795.00$

    year 3
    $A = 9795(1 + 0.05) - 600 = 9684.75$

    (d) Use a spreadsheet to determine how long it will take to pay off the loan. (Use a spreadsheet to do this! Be thoughtful about how you set this up so you can change the parameters!)

    See attached. It takes 37 years.

    (e) How much did the loan cost you? How much was interest?

    $36 \cdot \$600 + 416.37 = 21,416.37$ ← total cost

    $11,416.37$ ← interest only

    (f) What happens if you increase you annual payments to $800?

    See attached.
    It takes 21 years, costs $15,280.21 total costs

    and interest of 5280.21

1

2. (Compounded Monthly Example:) Suppose you take out a loan for $10,000 with an annual
   interest rate of 5% compounded **monthly** and you are going to make payments monthly.

   (a) What is the *minimum* annual payment that ensures you will eventually pay of the loan?
       (Round your answer to the nearest dollar.)

   after 1
   month
   $$I = 10,000 \left(\frac{0.05}{12} \right) = \$41.6\overline{6}$$

   So a monthly payment of at least $42.00
   is needed.

   (b) If you make a $200 payment each month, how many **years** will it take to pay off the
       loan and how much did you pay in total?

   See attached. It takes 56 months or

   $$\frac{56}{12} = 4.67 \text{ years.}$$

   You pay $ 11,036.77 of which $ 1036.77 is
   interest.

   (c) If you make a $299.71 payment each month, how many **years** will it take to pay off the
       loan?

   See attached.
   It takes exactly 3 years.

   So, if one wants a 3-year loan of $10,000
   at 5%, then one must make monthly payments
   of $299.71.

   NOTE: We will show you how to compute the payment value in 2c!